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Modelling of the echo generation process in bat echolocation

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Very few studies exist that attempt to model the detailed shape of the echoes generated by real targets in bat echolocation. The modelling becomes even more complicated when one attempts to take into account the specific acoustic characteristics of the bat as a source and receiver. Hence, the exact physical acoustics basis that underpins the target detection and classification capabilities demonstrated by bats remains a largely open research question. We use previously published work on real target echo measurement (Simmons and Chen, JASA 1989) as a starting point but modify their experimental method in a way that allows the incorporation of the bat's source and receiver characteristics in the modelling. Furthermore, we compare our measurements with analytically predicted results and show good agreement. We discuss how our experimental method can be used for the prediction of the binaural signals that constitute the actual input to the bat's auditory system during echolocation.